Presentation To FCC
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Ecology for

Interoperable Video Devices

conforming to FCC NOTICE # 27

(GN Docket No. 09-47, 09-51, 09-137 & CS Docket No. 97-80)

PRIMARY CONCEPTS

The solution is actually obvious. It is the mist surrounding which is obfuscating the vision.
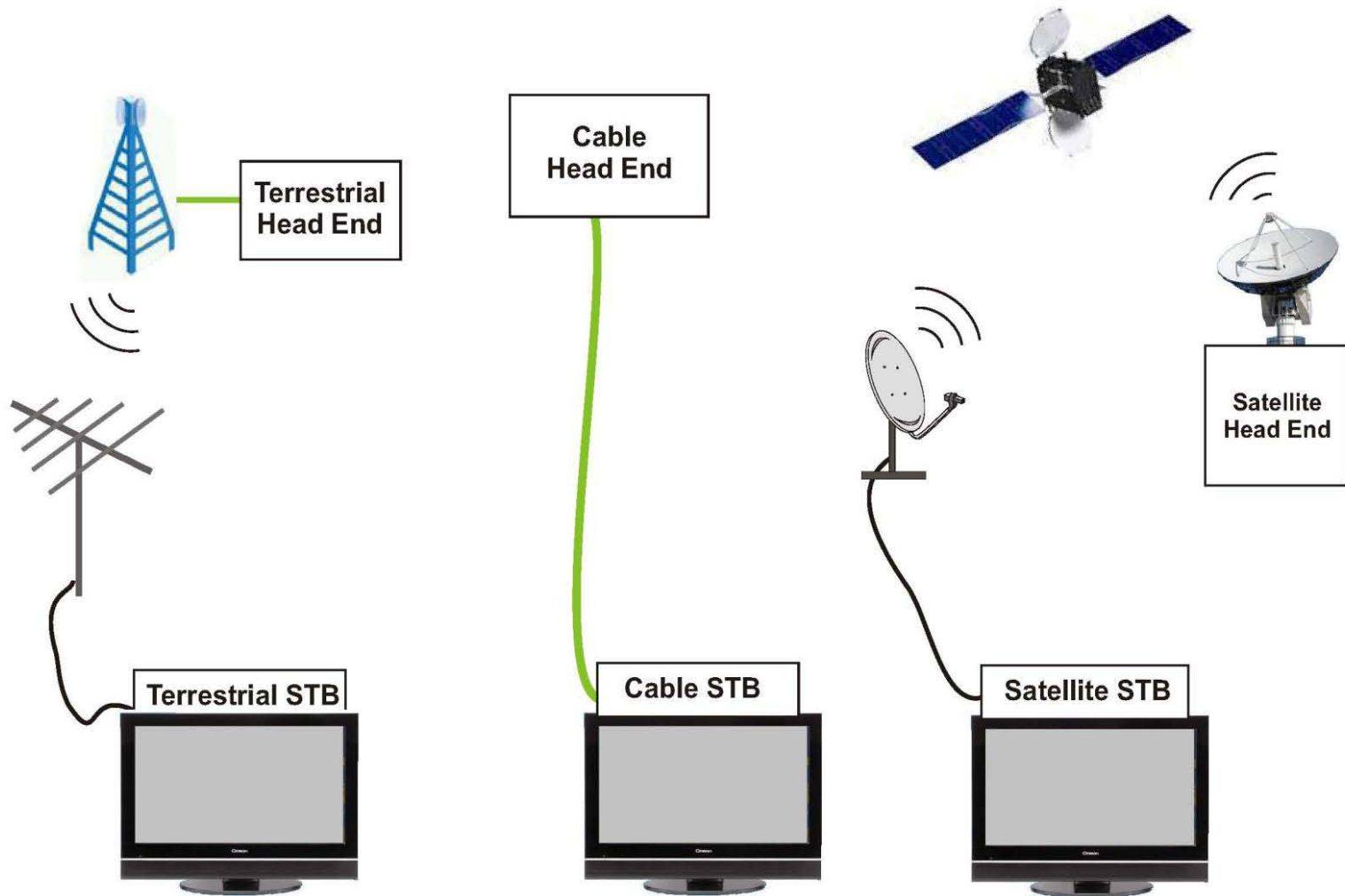
- We will just take out the mist, and everyone can appreciate the simplicity.

- Answers to the question posed in the FCC Public Notice #27, will become self-evident.

- Simplicity is Perfection.

Distinction has to be made between STB Devices and Video Devices.

- STB Devices had evolved for the Broadcast World

- Video Devices are evolving rapidly for the Internet World.

- The legacy STB devices cannot be made compatible to the requirement of the Video Devices.

- The new Video Devices, become complicated if they have to be compatible to proprietary STBs.

- Its best if both separately evolve, for their respective strength. At present TV will provide their convergence.
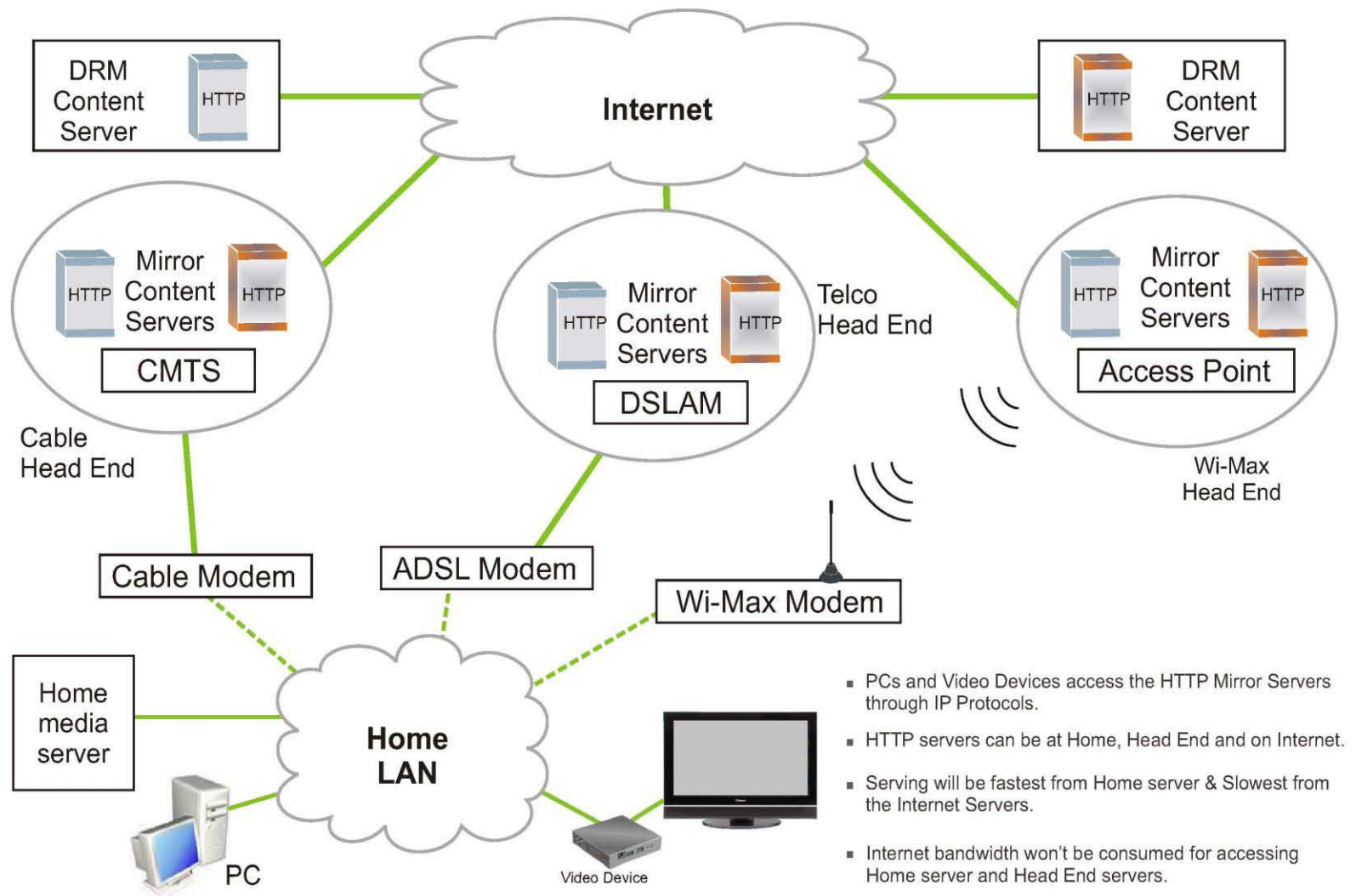
Terrestrial Head End

Cable Head End

Satellite Head End

Terrestrial STB

Cable STB

Satellite STB

Video Devices for the Internet World

Internet

DRM Content Server — HTTP

HTTP — DRM Content Server

Cable Head End

HTTP Mirror Content Servers HTTP

CMTS

Telco Head End

HTTP Mirror Content Servers HTTP

DSLAM

Wi-Max Head End

HTTP Mirror Content Servers HTTP

Access Point

Cable Modem

ADSL Modem

Wi-Max Modem

Home LAN

Home media server

PC

Video Device

- PCs and Video Devices access the HTTP Mirror Servers through IP Protocols.

- HTTP servers can be at Home, Head End and on Internet.

- Serving will be fastest from Home server & Slowest from the Internet Servers.

- Internet bandwidth won't be consumed for accessing Home server and Head End servers.

Wi-Fi

Satellite
Terrestrial
Cable

STB

Video
Device

Cable Modem   ADSL Modem   Wi-Max Modem

Wi-Fi Router

Ethernet

Satellite
Terrestrial
Cable

STB

Video
Device

Content is media agnostic. Content is nothing but a stream of bits (0's and 1's) and can be carried through any media.
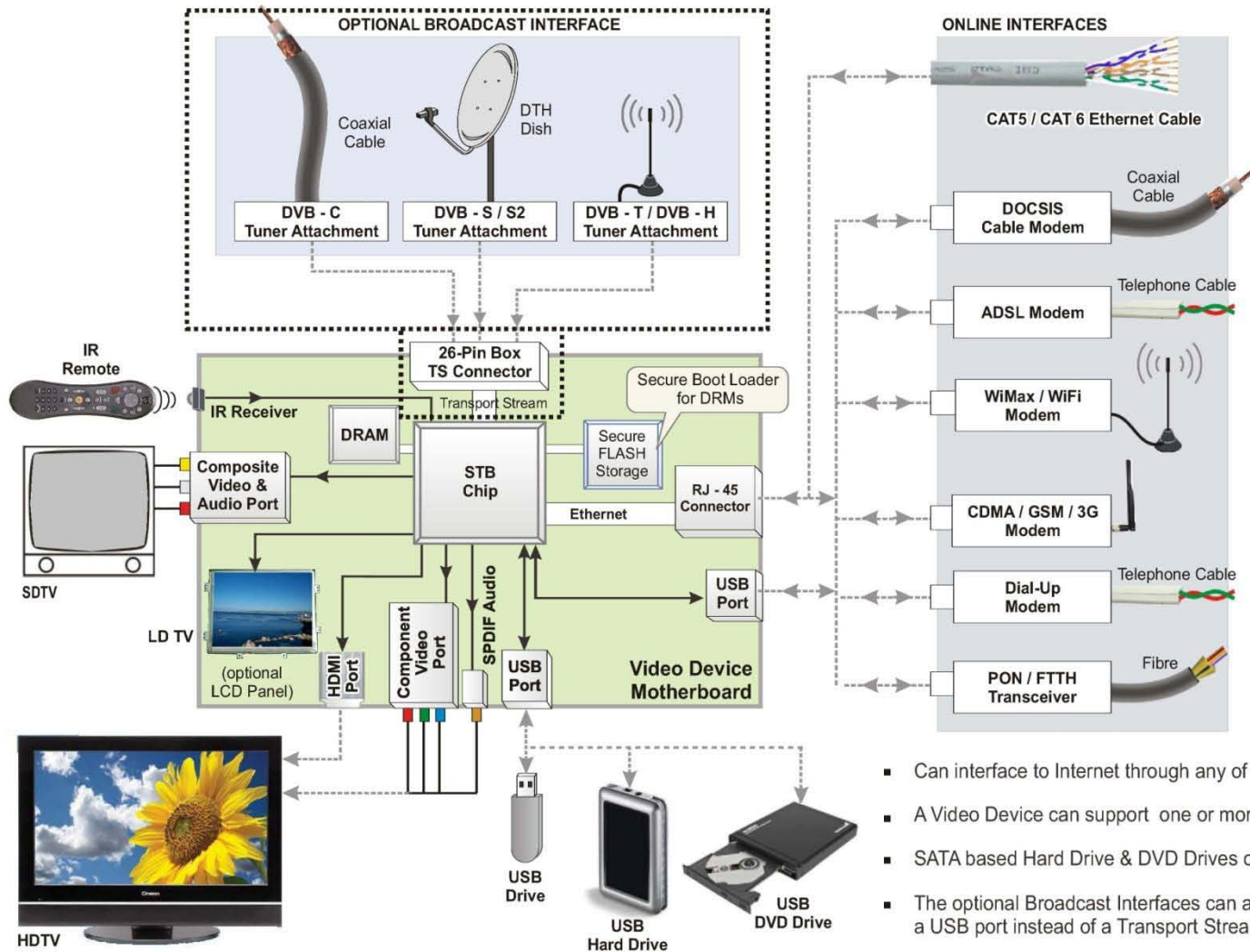
- Physical Media: Hard-disk, DVDs, USB Pendrive
- Broadcast Media: Cable, Satellite, Terrestrial
- Interactive: Internet, 3G

Video Devices, like other internet devices are network agnostic: They can display content on any attached display and can fetch it from any network.

- Ethernet/ USB Modem Interfaces:
- Modem: ADSL, PON, 3G,
- Wireless: WiFi, WiMax
- Physical Medium
- A Video Device would be Plug&Play like other internet devices.

OPTIONAL BROADCAST INTERFACE

Coaxial Cable

DTH Dish

| DVB - C Tuner Attachment | DVB - S / S2 Tuner Attachment | DVB - T / DVB - H Tuner Attachment |

ONLINE INTERFACES

CAT5 / CAT 6 Ethernet Cable

DOCSIS Cable Modem — Coaxial Cable

ADSL Modem — Telephone Cable

WiMax / WiFi Modem

CDMA / GSM / 3G Modem

Dial-Up Modem — Telephone Cable

PON / FTTH Transceiver — Fibre

IR Remote

26-Pin Box TS Connector

Transport Stream

Secure Boot Loader for DRMs

IR Receiver

DRAM

STB Chip

Secure FLASH Storage

RJ - 45 Connector

Ethernet

Composite Video & Audio Port

SDTV

LD TV

(optional LCD Panel)

HDMI Port

Component Video Port

SPDIF Audio

USB Port

USB Port

Video Device Motherboard

HDTV

USB Drive

USB Hard Drive

USB DVD Drive

- Can interface to Internet through any of the online interfaces

- A Video Device can support one or more displays and USB Drives.

- SATA based Hard Drive & DVD Drives can also be used.

- The optional Broadcast Interfaces can also be attached through a USB port instead of a Transport Stream (TS) connector.

Content can thus be delivered through any medium/network to a Video Device.

- In a physical medium, the content is carried as files.

- In a broadcast medium, the content is carried as "transport stream" which is delivered to a video device as a file.

- Through interactive medium, the content is carried using internet protocol and is delivered as a file.

- A content file can be played by a Video Device, even as it is getting downloaded.

There is already a common standard for Audio/Video Contents, which is popular.

- H.264 for SD/HD Videos

- AAC for Stereo or 5.1 Audio

- AVC-HD or Transport Stream (TS) for containing Audio/Video

- Above can be mandated, although a variety of different standards can continue to co-exist.

We are proposing a new standard for unique naming of the "Universal Contents"

- A set of guidelines can be prepared for giving a "Universal Content ID" (UCID) for each content.

- The UCID will be used as a unique file-name for the content.

- The UCID will have embedded fields identifying the type of contents, name of the content and the ID of the associated Content Aggregator.

- UCID will also have added Tags, identifying attributes such as Version, Censorship Rating, Encrypted state etc.

Universal Content Identifier (UCID)

Contents can be of different types: TV Programs, Songs, Videos, Ads, User Generated Contents

UCL for Videos

Video Resolution
FD - Full HD (1080p, 1080i)
HD - High Definition (720p, 720i)
SD - Standard Definition
LD - Low Resolution

Content Aggregator ID

iCV1eng(Cosmos -10) The Edge Of Forever 1980 -HD -Enc

Video Content
Language
Major Title (optional)
(absent for movies)
eg., Name of TV series
Minor Title
eg., Episode Name.
Year of release
Encryption Status
(absent if non-encrypted)

UCL for Songs

Video Resolution
FD - Full HD (1080p, 1080i)
HD - High Definition (720p, 720i)
SD - Standard Definition
LD - Low Resolution

Content Aggregator ID

iCS1eng(Shakira) Hips Dont Lie 2006 -Vid -HD -Enc

Song Content
Language
Major Title
(Movie, Album, Artist)
Minor Title
(Song Title)
Year of release
Video, or Audio
(absent if audio)
Encryption Status
(absent if non-encrypted)

Although on the web most contents are open, the precious contents such as movies and TV programs need to be protected.

- Each content has to be encrypted at the source for protection

- It can then be freely copied, and yet would remain encrypted.

- Popular Encryption standard such as AES-128 can be used.

Each DRM Server can have DRM modules from multiple parties.

- The content is encrypted using the same standard, although the License Keys can be generated differently by different DRMs.

- This allows video devices to get a protected content from anywhere, and fetch the corresponding License Key from the corresponding DRM Server.

- An Open DRM module can also co-exist with other DRMs.

DRM Content Server

- DRM Content Server is primarily a HTTP server for organizing & delivering encrypted contents.
- It contains third party S/W for generating/storing content keys in a secure database and associating policies with the keys.
- The License Key Generator can have multiple DRM modules from the respective DRM providers.
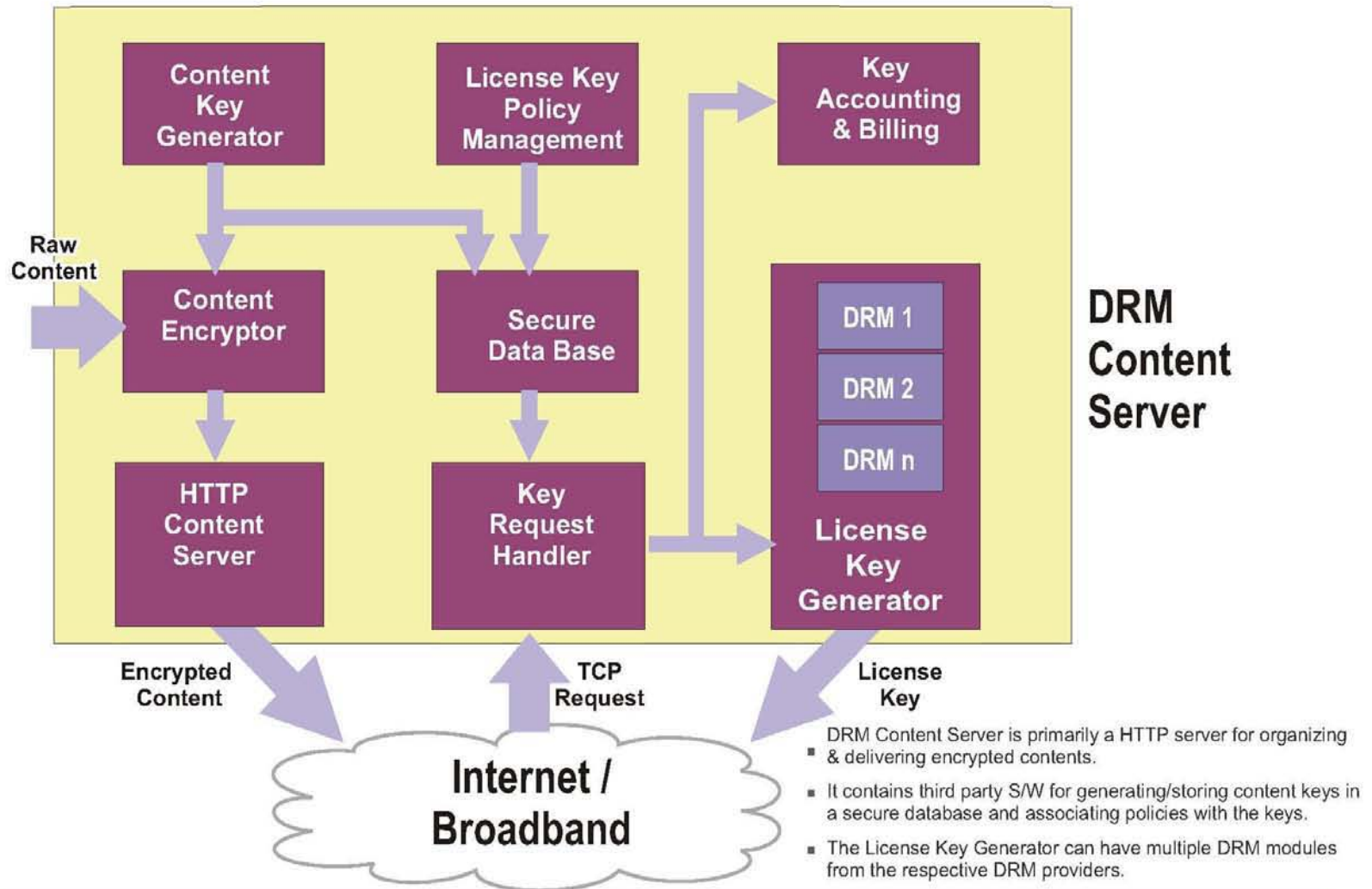
Each Video Device can discover contents using standard protocols, as in web.

- HTTP Servers can be used for organizing content the standard way.

- Internet Search Engines can search through the precious contents on these HTTP Servers too.

- Each Video Device can have their own navigation software to display the content list in the manner they prefer.

Mirror Content Server at a Cable Head End

HTTP

Mirror Content Servers

HTTP

Internet / Broadband Connection

LAN

CMTS

Channel Feed

Mixer

RF cable from cable operator
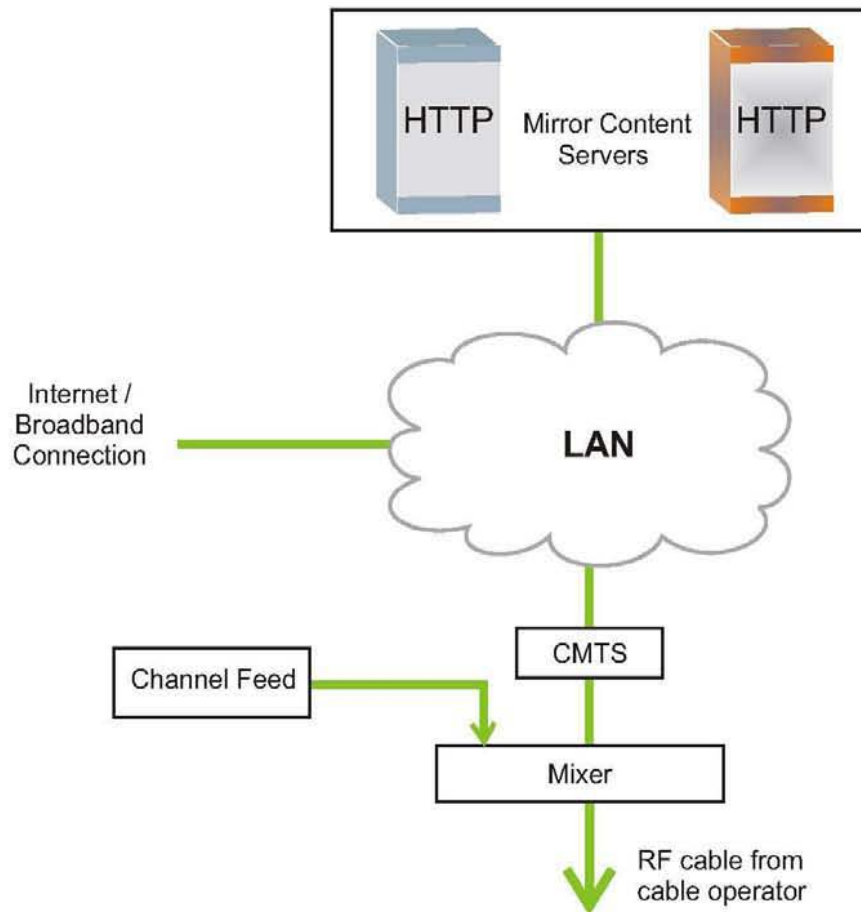
- A Video Device picks up contents from a HTTP Mirror Content Server.

- Each mirror server corresponds to a separate DRM Server.

- A Video Device fetches License key via Internet from the original DRM Content Server.

- Mirror Content Servers can also be used in other Headends such as telcos and Wi-Max.

Video Devices & Content Head Ends

- Encrypted contents can move between Content Servers, and Video Devices.
- Video Devices access contents from Mirror Servers at the Head End.
- License keys are always accessed from the original DRM Head End.
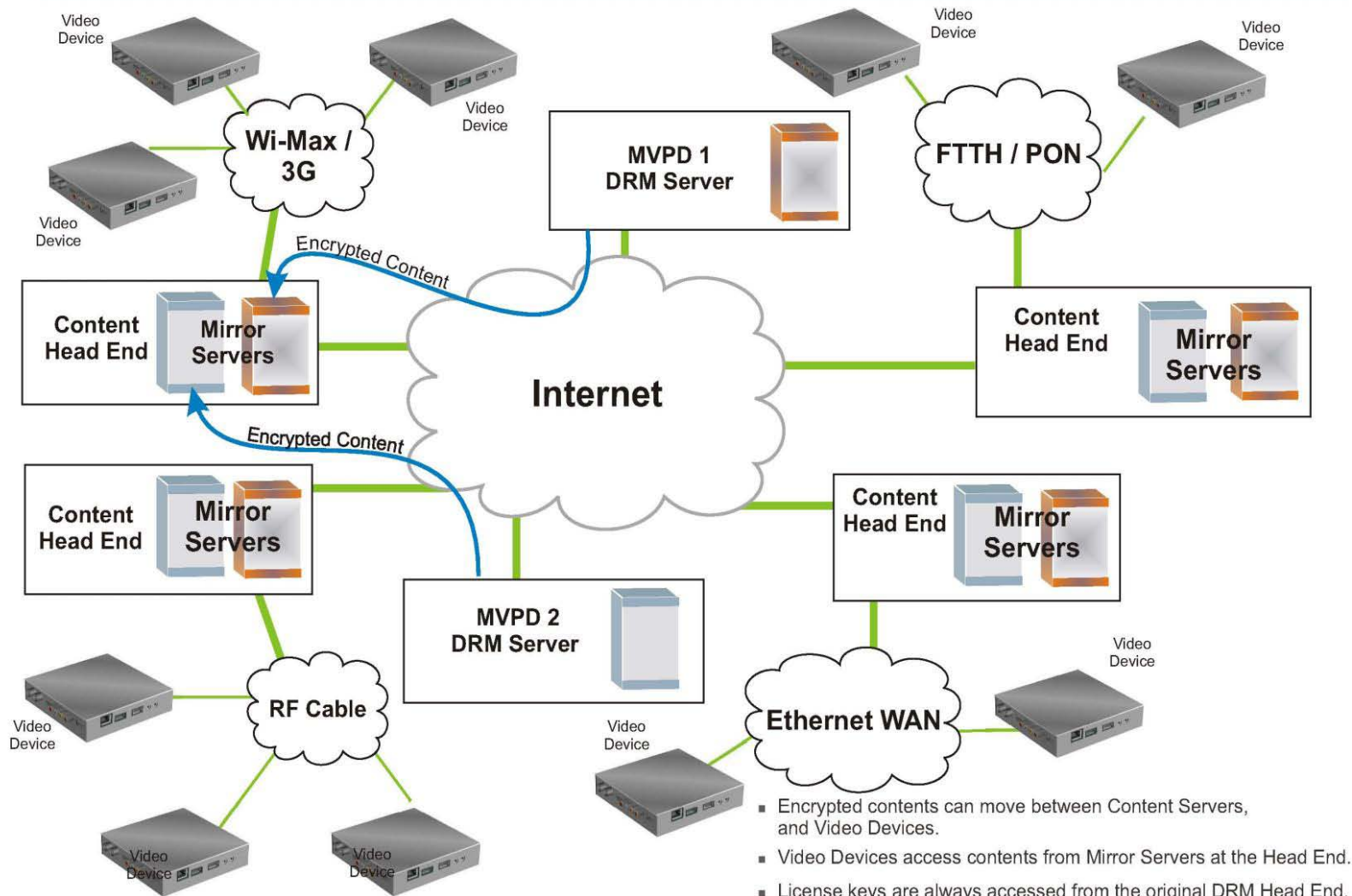
A License Key would be required for playing a protected content on a Video Device.

- A Video Device can get a protected content from anywhere, but won't be able to play it without the associated License Key.

- The License Key has to be requested from the same "DRM Server" which had originally encrypted the content.

- The DRM Server will deliver this License Key in a secure manner to the requesting Video Device.

A License Key would be required for playing a protected content on a Video Device.

- The DRM Client inside the Video Device will play the encrypted content only when it is presented along with the associated Licenses Key.

- The Content and the Keys are decoupled. While the content can be got from anywhere, the key is always got from the original DRM Server.

Content & License Key Server

Internet

Movie 1 & 2

Movie 3

DRM Content Server

MVPD 1

DRM 2 | HTTP Server | DRM 1

DRM1 | HTTP Server | DRM 2

DRM Content Server

MVPD 2

Encrypted Content

MVPD 1 | MVPD 2

Mirror Servers

Head End

Key Request For Movie1

Key Request For Movie 2

License Key For Movie 1

License Key For Movie 2

Movie 1

Movie 3

Key Request For Movie 3

Movie 2

License Key For Movie 3

Last Mile Network

Video Device With DRM 1

Video Device With DRM 2
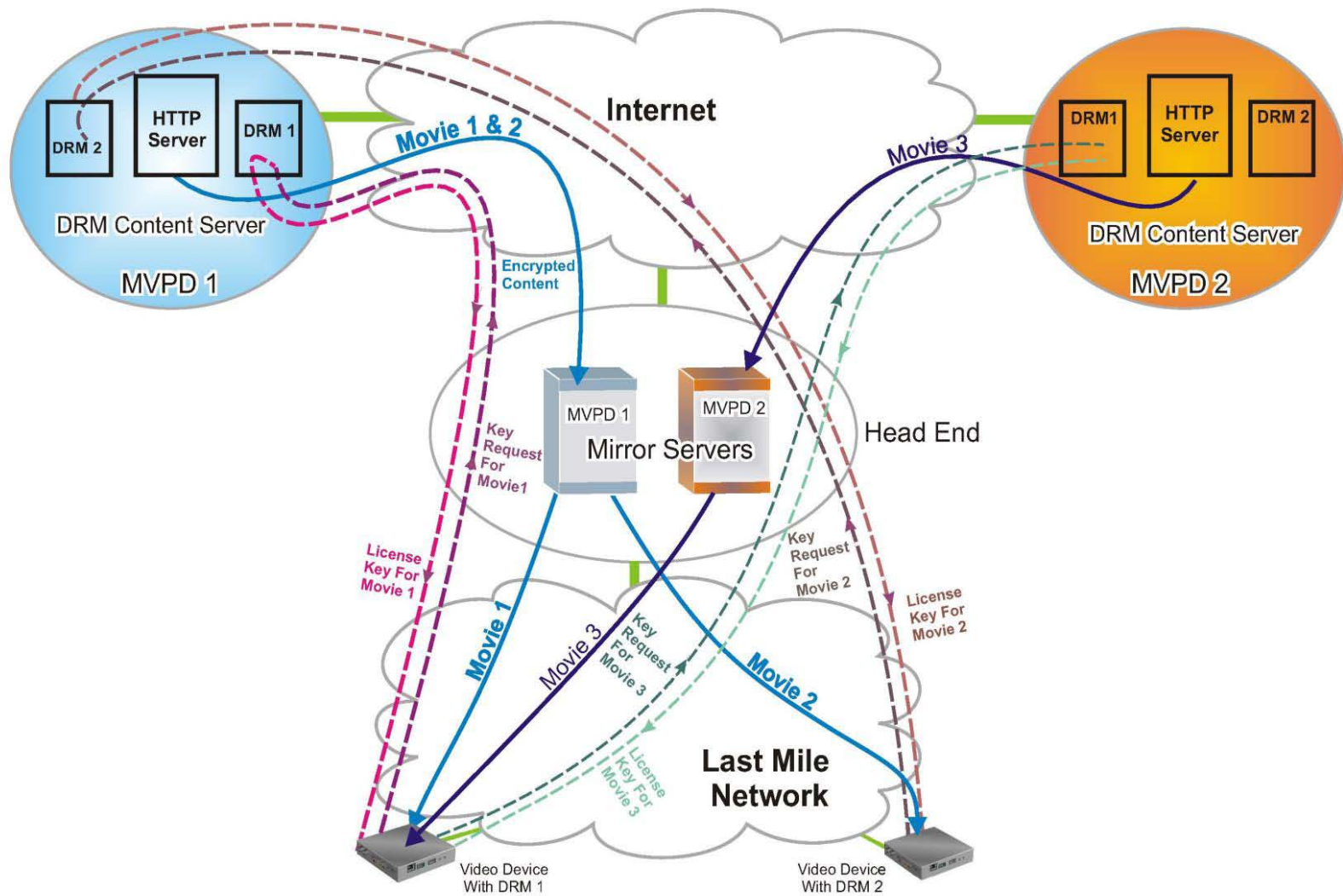
The policies specified by the License Key can be enforced even when the Video Device is not on-line.

- The Policies for using the contents are encrypted within the License Key.

- The Content can be played off-line, so long as the License key had been fetched earlier. This enables portable device usage.

- Policies can specify content usage restrictions such as: Duration, Expiry Date, Display restrictions, Water Mark restrictions.

True scalability of Internet, for allowing unlimited access of HD Videos, can happen only with free copying on a P2P basis.

- Internet is already facing a congestion due to videos.
- The HD Video load cannot be as such handled by the internet.
- Protected contents can as such be distributed by any means which decongests the main internet. This can be through physical media such as DVDs and USB pen-drives, or broadcast media such as satellite, or through P2P networks.

True scalability of Internet, for allowing unlimited access of HD Videos, can happen only with free copying on a P2P basis.

- As such the DRM Content Servers on the internet, can be decongested using Mirror Content Servers at Head-ends.

- With easy availability of contents, Piracy will disappear.

- P2P networks can do a wonderful job of distributing videos, without loading the central servers or internet.
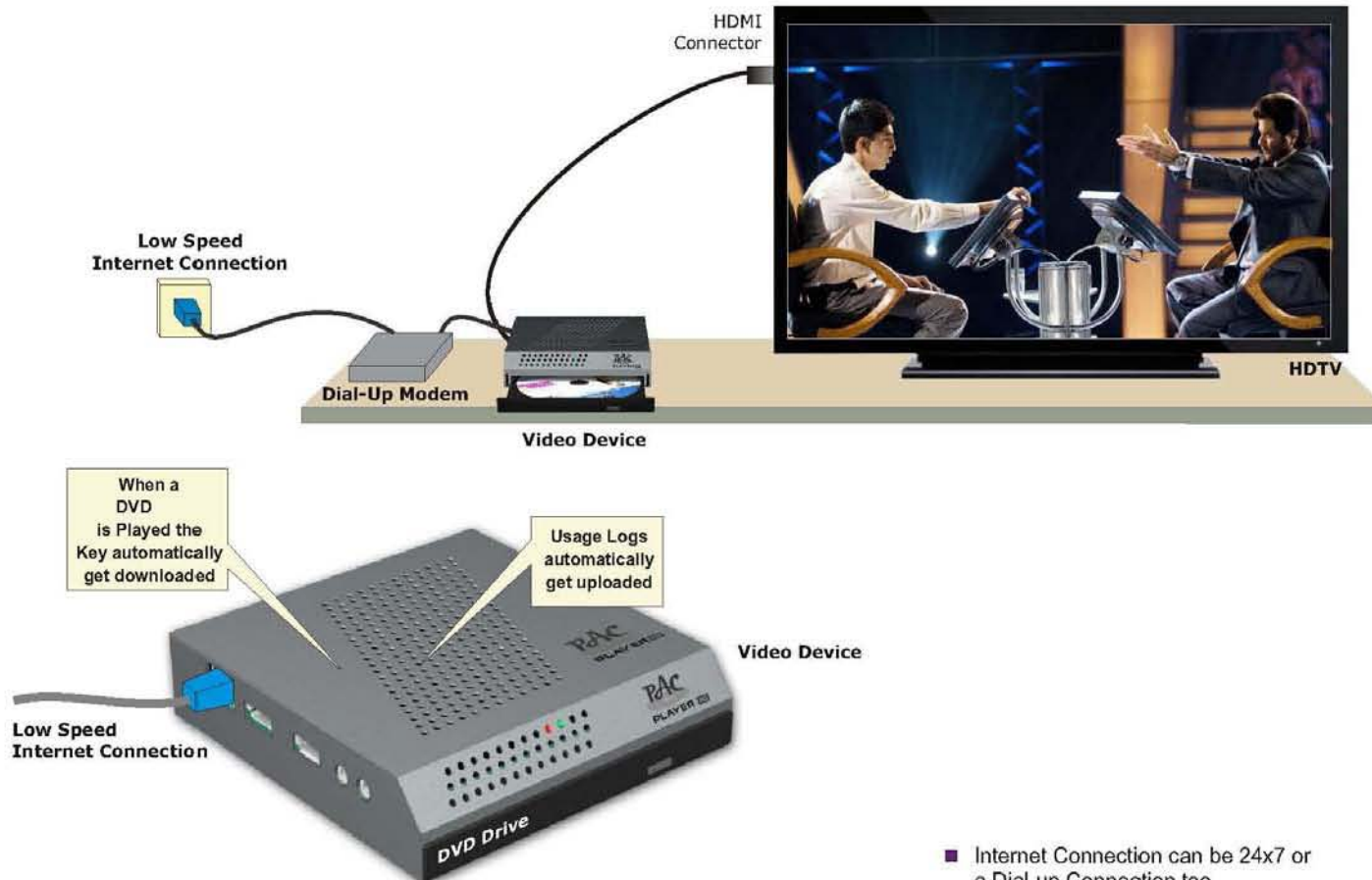
SECONDARY QUESTIONS

Although the Basic Points allow all possibilities to be deduced. Some of the important consequences are emphasized below.

Would Video Devices spur broadband use?

- Yes, since they will be ubiquitous along with TVs, which far outnumber the PCs.

- The Video Devices will require at least a low-speed internet connection, which will allow overnight downloads of contents, and fetching of the keys.

- With time and availability, most users will migrate to high-speed broadband connections, which will allow HD quality videos to be seen immediately.

Low Speed Internet Model with DVD Drive

HDMI Connector

Low Speed Internet Connection

Dial-Up Modem

Video Device

HDTV

When a DVD is Played the Key automatically get downloaded

Usage Logs automatically get uploaded

Video Device

Low Speed Internet Connection

DVD Drive

- Internet Connection can be 24x7 or a Dial-up Connection too..

- A Payment Gateway has to used for prepaid payments.

What prevents internet to be used for delivering premium contents to existing internet devices?

- This is already happening in a Garden walled way. A user is thus confined to the specific contents available with a specific server.

- Existing Streaming Servers can't cater to Video Devices which have an internet connection with insufficient bandwidth.

- PC's don't have a secure processor, and are not considered safe enough for playing of downloaded contents.

- Existing Video Devices have propriety DRMs which restrict the users to Garden Walled contents.

Would most of the precious Contents still remain within Garden Walls?

- No. These encrypted contents can float to any video device. The License Key for playing the same would be obtainable through any internet connection.

- A DRM Content Server will have as many DRM Modules as required for serving License Keys to different DRM Clients in different Video Devices.

- The DRM Content Server, can implement different charging policies for different regions.

- Alternatively, within a region, the same rates would be applicable for a content, irrespective of the delivery medium.

Would a retail market emerge for Video Devices, unlike what has happened for STBs?

- Video Devices like other Internet Devices would be sold through retail, as they can be used anywhere on a Plug&Play basis.

- Even existing Video Devices, can be upgraded for the new functionality through a remote software upgrade.

- Cable STBs were proprietary in nature and were tied down to the service providers. Consumers would thus take them only on a leased basis.

What are the minimum standards necessary for interoperable Video Devices?

- Internet protocols

- Content Standard: AVC-HD with H.264 video and AAC Audio.

- Content Encryption Standard: AES 128

- Universal Content ID (UCID): A set of guidelines, for unique naming of contents, so that corresponding DRM Content Server and Content Aggregator can be identified.

- Server Standard: HTTP

What are the minimum standards necessary for interoperable Video Devices?

- DRM Standard: Not necessary, as Multi DRMs can be used for delivering License Keys.

  - A Guideline is needed for the policies which each DRM needs to encode in the License Key and enforce through its Clients.

Is there a new Gateway standard required for connecting to a Home LAN?

- No Gateway standard is required, as all video accesses are using standard internet protocols.

- Existing Cable Modems can be used to connect to cable networks.

- Other networks can be connected through their respective modems, such as ADSL, PON. 3G, WiMax etc.

- The TV channels can be handled tomorrow using existing IP Multicast protocols.

Is there a home networking standard required for interoperability of Video Devices?

- The requirements are the same as those for interoperability of Internet devices.

- Home networking standards used by the industry are fine, but not necessary.

- Existing P2P protocols can be used by devices for efficient sharing of contents.

Should STBs become compatible to Video Devices?

- It is better to leave legacy broadcast channels and their STBs undisturbed.

- Legacy architecture can't be changed, and would soon become obsolete.

- There is no immediate problem in interoperable Video Devices co-existing with proprietary STBs, and sharing the same TV.

- With time, the Video Devices will evolve to receive Multicast TV channels over IP.

What would be the role of MVPDs with respect to STBs and Video Devices?

- MVPDs can optimize their proprietary broadcast network and STBs for minimizing the overall costs.

- MVPDs can facilitate usage of Video Devices by making the Mirror Servers accessible from their Head-ends through Cable Modems.

- As the user would be accessing Head-end servers, over local bandwidth, there won't be any associated internet cost.

- The availability of mirrored content at the Head-end itself, will help in de-congesting the internet.

Would a Converged Video Device become more complex and costly?

- The Video Device will be similar to a PC or a Mobile, where the basic functionality, provided by a single STB chip, can be very affordable

- Like the PC and Mobile, there can be high-end devices costing more, catering to exotic needs.

- It would be though possible to upgrade low-end models for more functionality using low-cost accessories.

- Example: It would be possible to interface to a Cable, through plug-in tuner accessory.

Would a Converged Video Device become more difficult to Certify, just like the Cable Card?

- Each Video Device will have one or more DRM clients, compatible to the Multi-DRM requirements. It is the job of the DRM provider to certify the Video Devices, and to ensure that they are hack-proof.

- Each DRM has to keep a record of the authorized Video Devices, through their MAC-IDs, and ensure that no device can spoof.

- The only central responsibility would be that of selecting the appropriate DRMs, and ensuring that they comply with the guidelines.

TERTIARY SOLUTIONS

How everyone's interest will be taken care of

- Content Aggregator

- Content Owners

- MVPDs

- Cable Operators

- Customers

- CE Manufacturer

- DRM Providers

Flexibility through an Open DRM

- Primarily for User Generated Contents.

- Will allow users to earn from the usage of their contents by others.

- Earning can be through sharing a Library fee paid by a Video Device.

- With this returns can come to each content owner, in spite of not charging any separate fee for the Library content.

AVC-HD DVD will become ubiquitous, and will eliminate Piracy.

- Now HD quality can be distributed through normal DVDs.

- These will be available at a very low cost form road-side vendors or vending machines.

- The DVDs can be played on a Video Device only after the License Key has been fetched. The required charging by the Content Aggregator will happen at this point.

End of Video Piracy

Road side Vendors

**Yesterday's Pirates will become
today's LOW COST DISTRIBUTORS**

- Users can buy DVD from Distributors at a low cost (physical media and handling).

- User will have to pay on a website for fetching the corresponding License Key before they use the content

- The same applies for downloading videos through Internet.

Advantages of HTTP Servers over Streaming Servers

- HTTP Servers are low-cost and can handle unlimited users on a P2P basis.

- There is no dilution of the quality of the Video content, as necessary when Streaming in real-time and remaining within the band-width restriction.

- During play the contents are downloaded ahead by a HTTP Server, which allows a glitch-free play even during disturbances on a wireless network.

What is needed in a User Friendly DRM.

- Freedom of making copies of content as well as License Key for backup purpose.

- Freedom of making copies of contents and distributing it.

- Being able to view the contents off-line.

- Policies of the usage continue to be enforced even in the off-line mode.

- No need to Own Contents, as almost everything will be available on a Library basis.

- Allows usage even when there is no internet connection. (Done using a Sync USB-Stick).

Advantages of a DRM Content Server

- The same server which is encrypting, gives out the License Keys too. Even the administrator will not have access to the raw keys, preventing any leakage.

- Although the content is encrypted in a uniform way, the License keys can be distributed through any of the multiple DRMs, coexisting on the DRM Content Server.

In Conclusion

- FCC has been influencing the technology growth in USA, and indirectly in rest of the world.

- Chaos in the cable world, during the past decade, has had negative fall out even in other countries such as India.

- A direction to the Convergence industry in USA today, can have positive ramifications through-out the world.

- The FCC interoperable Video Device, will lay the stage for emergence of the Next Generation Internet, where HD quality videos will zip around every TV in the world.